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Systemic Design: Two Canadian Case Studies

Abstract

This paper introduces two novel applications of systemic design to facilitate a comparison of alternative methodologies that integrate systems thinking and design. In the first case study, systemic design helped the Procurement Department at the University of Toronto re-envision how public policy is implemented and how value is created in the broader university purchasing ecosystem. This resulted in an estimated \$1.5 million in savings in the first year, and a rise in user retention rates from 40% to 99%. In the second case study, systemic design helped the clean energy and natural resources group within the Government of Alberta to design a more efficient and effective resource management system and shift the way that natural resource departments work together. This resulted in the formation of a standing systemic design team and contributed to the creation of an integrated resource management system. A comparative analysis of the two projects identifies a shared set of core principles for systemic design as well as areas of differentiation that reveal potential for learning across methodologies. Together, these case studies demonstrate the complementarity of systems thinking and design thinking, and show how they may be integrated to guide positive change within complex sociotechnical systems.

Keywords: systemic design, design thinking, systems thinking, methodology, comparative analysis, procurement, natural resource management.

Introduction

The currently fragmented state of ‘systems + design’ praxis is curious in light of the affinities between the two interdisciplines. Systems philosopher C. West Churchman said: “A systems approach begins when first you see the world through the eyes of another” (1968). This resonates with a basic tenet of design thinking: begin with empathy for users/stakeholders. Tracing the connection in the other direction, the architect Eliel Saarinen provided the following counsel: “Always design a thing by considering it in its next larger context – a chair in a room, a room in a house, a house in an environment, an environment in a city plan” (quoted in Saarinen, 1977). In drawing attention to the importance of the next larger context, Saarinen was advising designers to approach their challenge as an open system. An even stronger link was made by systems thinker Russell Ackoff. “Design is the future of systems methodology” (quoted in Gharajedaghi, 2011).

This begs the question: why haven’t more designers and systems thinkers been talking to each other? To answer this, we must first look to their differences. Design emerged as an evolution of craft (Jones, 1992). Donald Schön describes the intellectual foundations of design as rooted in an epistemology of practice (1987). The founder of IDEO, David Kelley, articulates this as “thinking with your hands.” Drawing, prototyping, and making are central to designing.

In contrast, Peter Checkland suggests that systems thinking was founded on two pairs of ideas (1981):

1. Emergence and hierarchy, originating in organismic biology and generalised in General System Theory; and
2. Communication and control, originating in communication engineering and generalised in cybernetics.

General System Theory placed systems thinking above the disciplinary sciences, in order to provide a non-reductionist foundation for the unity of science (von Bertalanffy, 1969). The closely coupled field of cybernetics set a similarly ambitious research agenda, in which it sought to establish a general mathematics of machines. According to Norbert Wiener, who suggested the name for the field:

cybernetics attempts to find the common elements in the functioning of automatic machines and of the human nervous system, and to develop a theory which will cover the entire field of control and communication in machines and in living organisms (Weiner, 1948).

Whereas the designer learns by doing in concrete situations, from the very beginning of the systems approach, the systems thinker's knowledge has accrued by abstracting away from the particular details of any specific instance of practice.

But if this genealogy is sufficient to account for the lack of dialogue between and synthesis of systems + design, then the two interdisciplines are on a collision course. Since the mid-20th Century, design has followed a trajectory of increasing abstractness, migrating from the design of objects, to the design of services, identities, interfaces, networks, projects, and discourses (Krippendorff, 2006). The emergence of the term 'design thinking' acknowledges this more abstract application of design, often at organizational and societal scales. At the same time, systems thinking has all but abandoned its ambitions to provide a unity for science. Instead, a diversity of systems approaches have flourished. This includes systems approaches that subscribe to the methods of action research (Checkland & Holwell, 1998). Action research (Lewin, 1946), an iterative and collaborative process to improve a situation simultaneously with learning about it, firmly grounds systems thinking in situations of practice. This collision of systems + design threatens previously occupied intellectual territories, so it could be violent. Yet it also contains enormous creative potential that might be harnessed to better connect theory and practice to produce actionable knowledge.

The authors of this paper are approaching the scene of the collision from opposite, but not opposing, directions. One of us is a systems thinker who got involved in the messy business of institutionalizing design within the U.S. military. The other is a business designer who increasingly needs systems thinking to fold design into the core of business strategy development. Although our methodologies were developed independently (see Martin, 2009; Naveh, Schneider & Challans, 2009), we have found they provide enough similarity to be commensurable, and enough differences to stimulate critical reflection.

In this paper, we will present two new case studies where systemic design was applied with impact to address strategy and organizational challenges. Before introducing the case studies, we briefly define what we mean by systemic design and provide a comparison of our respective methodologies. In the following section, our first case study concerns a public procurement project within the University of Toronto, where design and a systems mindset helped the Central Procurement Department re-envision how public policy is implemented and how value is created in the broader university purchasing ecosystem. Our second case study involves improving the effectiveness of the clean energy and natural resources group (hereafter abbreviated to the natural resources group) within the Government of Alberta. Design was used here to reframe the way that the five departments within the natural resources group work together and to create a learning system for continuous improvement. Next, we perform a comparative analysis of the two methodologies as applied to the case studies introduced above. We conclude the paper by interpreting these case studies as a contribution to knowledge on how systems + design might be synthesized to create a practical approach to systemic design.

The Shape of a Systemic Design Project

Systemic design integrates systems thinking and design thinking. By systems thinking, we mean a way of looking at, modeling, and intervening in the world as if it is composed of open, purposeful, complex wholes. By design thinking, we mean a normative, user-centered, iterative approach to innovation that extends the application of design beyond the design of symbols, objects, and interactions. By synthesizing systems thinking and design thinking, systemic design creates a learning system capable of adapting to a changing environment through iterative framing and reframing, spanning action and reflection on action.

The two methodologies considered in this paper are shown in Figure 1 below. On the left, Rotman’s design thinking methodology is represented as a series of three gears: Empathy and Needfinding; Ideation and Prototyping; and Business Strategy. On the right, the design methodology evolved by the U.S. Army is shown as three activities: Environmental framing; Problem / Opportunity Framing; and Operational Approach. While this methodology was developed within a military context, it has also been applied to civil and commercial design challenges. Both methodologies guide the practitioner in moving from deepening and broadening understanding towards taking strategic action to improve the situation.



Figure 1. Rotman’s Design Thinking Methodology and the U.S. Army’s Design Methodology.

Case 1: Public Procurement

In 2008, the Procurement Department at the University of Toronto decided it needed to re-examine how it served the university’s expansive research community. Adoption of its procurement services and compliance to purchasing processes were at an all time low. With more than \$1.1billion in research funds under the university’s stewardship, the department was tasked with ensuring that the school’s 17,000 faculty and staff delivered “value for money” on the goods and services they purchased. The department had great expertise in government policy and purchasing systems, but they had very little understanding of why researchers would not follow their rigorous processes. DesignWorks, the innovation research team at the Joseph L. Rotman School of Management (University of Toronto) was asked to investigate. Over the course of 3 months, each of the methods found in the 3 Gears of Business Design were applied (Table 1).

Table 1. Key stages of the University of Toronto Procurement project.

Gear	Empathy & Need Finding (6 weeks)	Ideation & Prototyping (4 weeks)	Business Strategy (2 weeks)
Method 1	User Observation & Storytelling	Co-Creation	Activity System
Outcome	<i>Team understands the user's perspective and context</i>	<i>Team generates Ideas with Users. Engages users for buy-in</i>	<i>Team identifies the key strategic focus areas and how the organization needs to be designed</i>
Method 2	Need Finding	Journey Map	
Outcome	<i>Reframes the problem from the user's point of view</i>	<i>Team and users understand how solutions might be experienced</i>	
Method 3	User Personas	Prototyping	
Outcome	<i>Team understands who they are designing for</i>	<i>Physical low resolution artifacts that generate user feedback and learning</i>	

The starting project objective of “How might we better design our value proposition to our users?” was deliberately open and broad to allow new questions to be asked and new possibilities to emerge. The research goal was not to immediately solve the problem from a policy or technology perspective as Procurement had done for many years but to understand the stakeholders’ (i.e. faculty, staff, officers) point of view and ultimately their unmet needs. This required the team to empathize with them and understand their everyday context and experiences. For several weeks, the team shadowed 20+ research faculty and staff at work and listened unbiased to their research stories (e.g. How did you get started? Why research? How does it feel? What challenges you?). The technique expanded to include other key stakeholders such as business officers and vendors to better understand the broader procurement ecosystem and how the players interact and influence one another.

With this empathic understanding, the team synthesized the essence of each key stakeholder and their needs as personas (Figure 2). This explicit and visual artifact gave everyone on the design team including Procurement a central design focus (i.e. Who are we designing for? What are they like? What do they really need?).



Figure 2. Researcher and Lab Manager Personas & Needs

The stakeholder stories led to a powerful reframe of the challenge for the Procurement team: procurement should not be the “enforcers of policy” but a “trusted advisor” for the community. This was further crystallized by the researcher comment: “Policy should be about helping us do better research and not the other way around – help us spend our dollars better and faster.” This insight, although obvious in hindsight, completely shifted the mindset of the department and the purpose of their work (i.e. helping people rather than helping the process).

With this understanding in mind, the team set up a series of evening co-creation sessions with researchers, staff, technicians and business officers to address the unmet needs. The session brief was to design the ideal research experience from start to finish using various brainstorming and prototyping techniques (e.g. journey mapping – Figure 3, sketching, storytelling, low-res craft building – Figure 4). The physical and tangible nature of the prototyping process got everyone engaged in the design process and made vague ideas very tangible and interactive.

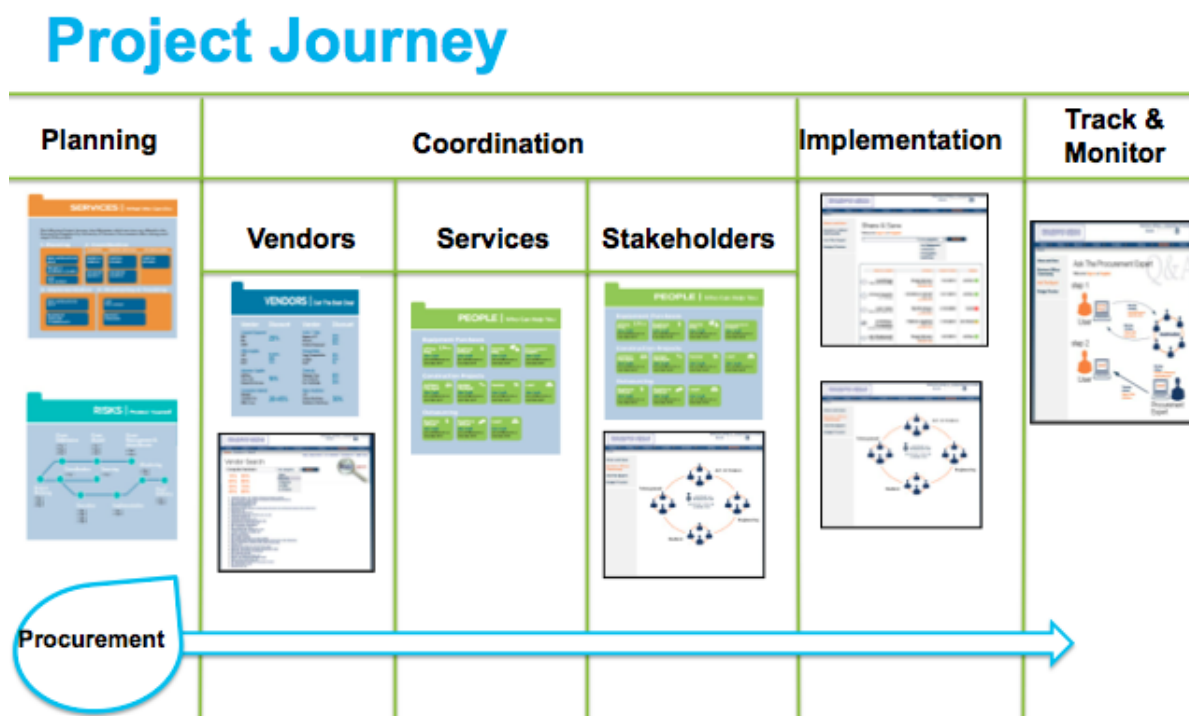


Figure 3. Procurement Journey Map



Figure 4. Prototypes of Procurement Fact Sheets

Over the course of a few days, the team then tested the prototypes with users in workshops and in the field, receiving highly valuable feedback: what they liked, didn't like and would change. They learned that to be the trusted advisor: procurement needed to be talking with the researcher on Day 1 when the funds are approved and the start of planning rather than at the purchasing implementation stage which was conventional practice and frustratingly late; and simple artifacts like tip sheets within easy access and simple language can go a long way to stay on top of researchers' busy minds and save time. This rapid testing allowed the team to make quick and inexpensive changes to their ideas before any significant investment needed to be made.

The inclusion of the key stakeholders in the solution design process led to higher engagement with Procurement, created buy-in to the ideas that were generated in the sessions and demonstrated Procurement's genuine effort to help make the experience better for the research community.

This work led to a department simplification and engagement initiative that aimed to make purchasing more accessible and efficient for researchers to use. This included the design of an award winning dynamic public procurement process that incorporated flexible deadlines, real-time feedback, user-friendly language and process simplifications to the procurement experience (Figure 5).



Figure 5. An activity system for better meeting the needs of end users of the University of Toronto's Procurement Services.

As a result of this project, user retention rates for Procurement Services jumped from 40% to 99%. In the first year, the pilot program was estimated to have returned \$1.5 million in hard dollar savings and won accolades from researchers. One of the biggest benefits of the design methodology would be in the transfer of thinking and skills to the department as stated by the Director:

In the past, we've looked at users' needs from our perspective. From our exercise with DesignWorks, it is very clear at a strategic level, we need to understand the users' perspective from a holistic approach and have really taken it to heart. Strategically, we hope to apply this to every program we have. We've actually piloted a program which is one of the biggest accomplishments we've had in 12 years.

In 2012, Procurement Services received the Canadian Association of University Business Officers (CUABO) industry award and the University of Toronto's Excellence through Innovation award for their transformational redesign of public procurement.

Case 2: Natural Resources Management

In 2012, leaders within the Government of Alberta stated that there was a need to 'change the channel' on how the departments think about their work, and how they actually operate. The natural resources group within the Government of Alberta chose to undertake a systemic design inquiry in order to improve the efficiency and effectiveness of the Government of Alberta's role within the natural resources management system. The workshop was facilitated by Booz Allen Hamilton's Center for the Application of Design. Starting with an intensive six day design workshop using the U.S. Army's design methodology, the team of nineteen civil servants developed a deeper understanding of the natural resources group's role within the natural resources management system, reframed their mindset, and devised an innovative operational approach to improving inter-departmental collaboration.

The client's stated objectives for the workshop were to:

- Raise awareness of the design methodology as a systemic approach to messy strategic problems;
- Apply the design methodology to a current strategic problem as a proof of concept to demonstrate institutional relevance; and
- Develop design skills in leaders across Government of Alberta Departments and Divisions to enhance systems thinking and improve collaboration.

In addition to these objectives, the client drafted the following guidance statement to motivate the systemic design inquiry:

Guidance Statement Version 1.0

Develop a three year strategy for the [natural resources group] departments to improve the effectiveness and efficiency of the Alberta Government's management of natural resources that will streamline our interaction with industry, improve environmental outcomes, and maintain or increase the revenue stream from industry while increasing public support for our social license to develop our natural resources.

This statement is intentionally broad, ambiguous, and raises possible value conflicts between economic, social, and environmental outcomes. The guidance provided purpose and direction, while allowing scope for reframing and refinement throughout the inquiry.

The first day of the workshop provided theoretical foundations for systems thinking, design thinking, and integrative thinking. The day consisted of a mixture of lectures, discussion of assigned readings, and skill-building exercises. The actual schedule for the practical component of the workshop over the remaining five days is shown in Table 2 below. The actual schedule differed from the planned schedule, since iteration emerged from the group's choices rather than occurring at preplanned intervals. Also note that three days were devoted to exploring the context, compared with only one day framing the problem and one

day framing the operational approach. This helped to build shared understanding and avoid premature convergence on the received problem implied by the original guidance statement.

Table 2. Schedule for the practical component of the natural resources management workshop.

	Day 2	Day 3	Day 4	Day 5	Day 6
Activity	Environmental Framing			Problem / Opportunity Framing	Operational Approach
Method 1	Appreciate Guidance	Guidance Reframing	Legacy to Alternative Mental Model	System of Support	Synthesis
Outcome	<i>Team understands the project purpose</i>	<i>Team choice of new boundaries for the inquiry</i>	<i>Situation viewed from a new, shared perspective</i>	<i>Map of actors supporting the transformation</i>	<i>Umbrella idea for how to transform the system</i>
Method 2	Stakeholder Mapping	Mapping Current System	Reframed Current System	System of Opposition	Rich Picture
Outcome	<i>Visualization of relevant actors and relationships</i>	<i>Visualization of the system in context</i>	<i>System redrawn from the new perspective</i>	<i>Map of actors opposing the transformation</i>	<i>Visualization of the operational approach</i>
Method 3	Affinity Diagram	Causal Layered Analysis	Potential System	System of Resources	Learning System
Outcome	<i>Actors and issues grouped into named clusters</i>	<i>Appreciation of deep drivers of the current system</i>	<i>Visualization of the potential future system</i>	<i>Map of resources used for or against transformation</i>	<i>Model of how the group will create a learning cycle</i>

Design methods such as stakeholder maps and affinity diagrams were used to collaboratively construct a shared map of actors and issues, which was then iteratively developed into a systems map, shown in Figure 6. In addition to using different methods, the team iterated between plenary and small group (three groups of approximately 6) formats to balance shared understanding and active participation. Group membership was regularly mixed up to minimize clique formation. The process of creating the systems map artifact clarified the common purpose of five government departments. Participants described these departments as historically operating in isolated silos, yet Figure 6 emphasizes the interdependence of the departments for achieving a common goal.

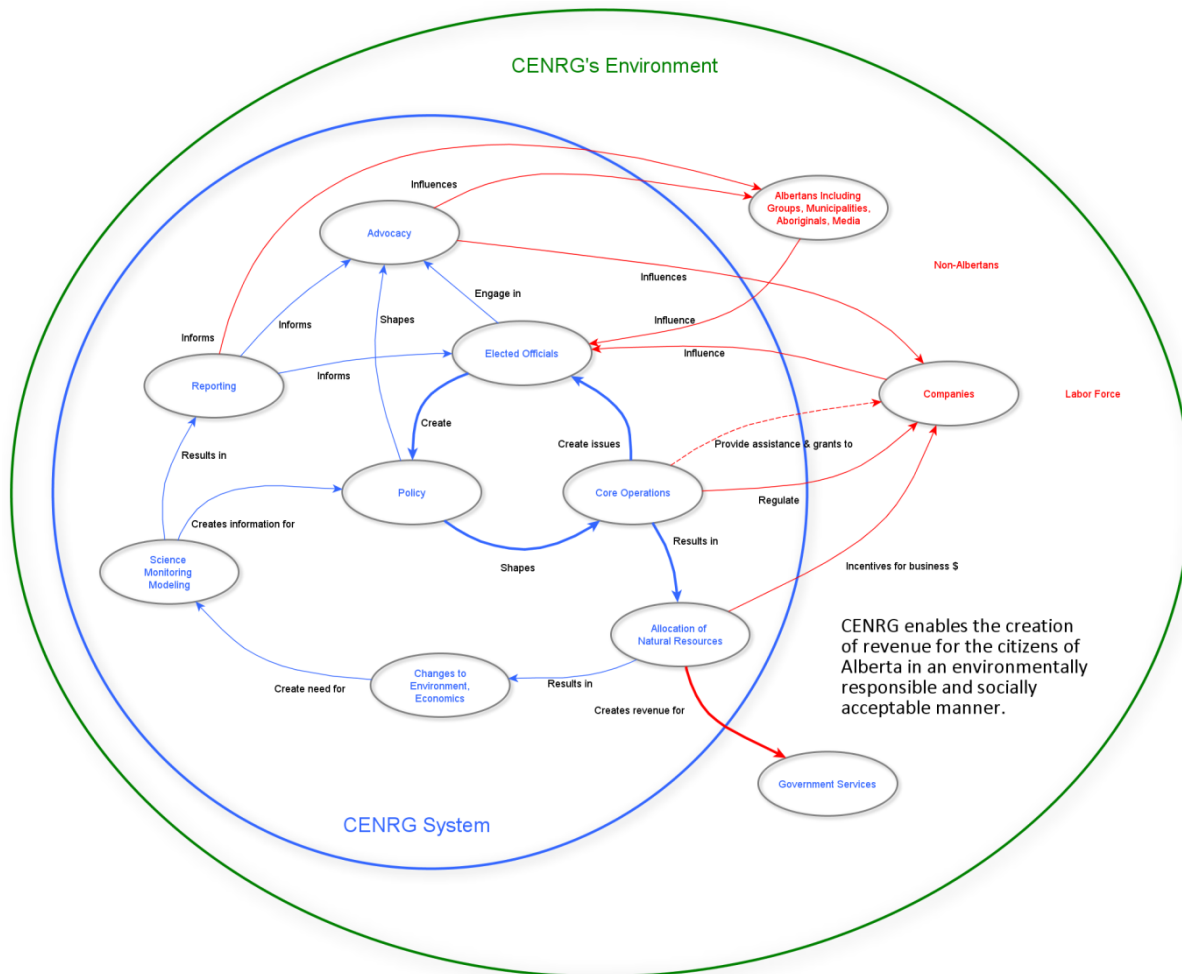


Figure 6. A systems map of the Government of Alberta's Clean Energy and Natural Resources Group.

During the process of mapping the actors and issues, participants raised questions about the guidance statement. Was it: the efficiency and effectiveness of the natural resources group that needed to be improved; the efficiency and effectiveness of the natural resource management system; or efficiency and effectiveness of the natural resource system? After debating and resolving this and several other issues with the guidance, the team reframed the statement to better reflect their shared understanding of the purpose of the design challenge:

Guidance Statement Version 2.0

Gain an understanding of the Natural Resources management system and its relationships to other PODs. To improve the efficiency and effectiveness of the GoA's role in managing that system, with a view to supporting economic prosperity, environmental quality, and quality of life.

This reframing was important for building team member commitment to the workshop. Additionally, it underscored the provisional nature of all design artifacts and the need for constant iteration in systemic design.

Next, the team performed a causal layered analysis to appreciate the current situation beyond the litany of media headlines to examine the systemic causes, worldviews / discourses, and myths / metaphors that perpetuate the issues currently impacting on natural resource management. Systemic causes identified include the siloed structure of the Government of Alberta, natural resource dependence, and demographic shifts. The myth of the cowboy was seen to be at the core of Albertan identity. The cowboy myth explains the

connection with the land, the rugged independence, and the lack of a need to justify actions to others. Cowboys live on the frontier, they are heroes, they operate outside the law, and relate to the stereotype of the redneck. Even though Alberta’s demographics have changed rapidly in recent decades, this has not undermined the power of the cowboy myth. It does mean, however, that it is no longer easy to identify the typical Albertan. One participant sketched Magritte’s *Son of Man* to depict the faceless modern Albertan.

The causal layered analysis enabled the team to surface a legacy pattern of thinking about natural resource management. The legacy mental model was initially developed through collaborative brainstorming, and iteratively structured offline. The theory of action framework used by Chris Argyris (1993) for mapping how values-in-use affect action strategies, systemic patterns, and consequences in organisations was found to be a useful way to organise the group’s brainstorming. The outcome is shown in Table 3 below.

Table 3. Legacy values, action strategies, patterns, and consequences.

Values in Use	Action Strategies	Patterns	Consequences
Control	Control information	Unclear authorities	Limited span of loyalty
Risk averse	Secret Minister’s Reports	Fragile relationships	Narrow identity
Technical knowledge	Collaboration as risky	Silos	Fragmented
Public service	Fight & die for the part	Zero-sum games	Questions of legitimacy
Team loyalty	Errors of omission	Time pressure	Lack of trust
Make a difference	Blame lack of resources	Strategy-execution gap	
Security	Blame lack of leadership		

The team imagined an alternative to this reinforcing set of values, actions, patterns, and consequences, which is documented in Table 4 below.

Table 4. Alternative values, action strategies, patterns, and consequences.

Values in Use	Action Strategies	Patterns	Consequences
Risk tolerant	Question guidance	Important over urgent	Stronger collective vision
Embrace complexity	Slow down to speed up	Risk-tolerant leadership	Meaningful change
Government of Alberta identity	Purposeful action, strategic influence	Growing understanding	Communities of practice
Transparency	Continuous learning	Continual adaptation	Development pathways
Security and stability	Fight for the collective	Growing trust	
	Control information by exception	Shared accountability / shared reward	
	Succession planning	Collaboration as reward	

This voluntary shift from control of my piece (“fight and die for the part”) to collaboration with the collective (“shared accountability and shared rewards”) provided an essential change in perspective required for the design team to look at the system in a new way and identify new potential for innovation and growth. The team identified potential for strengthening collective identity within the government, changing the nature of the relationship between the natural resources group and its stakeholders, enabling a “kaleidoscopic vision” for the province, reducing the volume of urgent-but-unimportant distractions, and imagining the government’s role from unconventional perspectives.

To help translate this potential into reality, the team mapped out a system of support (actors working to implement the transformation), a system of opposition (actors resisting the transformation), and a system of resources (means that can be used to support or oppose

change). They developed a broad operational approach that synthesised the team's divergent ideation into a coherent strategy for action. This artifact provided an umbrella concept that allowed the team to continue working on the detailed design of the natural resource management system in sub-groups for the next three months.

The project resulted in greater clarity on objectives, a framework for structuring collaboration, and a re-conceptualized mode of engaging with stakeholders that achieves alignment through strategic influence. More importantly, these organizational components were organized into a learning system, capable of continuing to deepen understanding and adapt to a changing environment. At the same time, participants learned a systemic design methodology. One participant provided the following qualitative feedback:

I can think of many situations, projects and issues we have encountered in the past in which this methodology would have been extremely useful - and we are already applying it in several current situations with great success. The fact that we have senior leaders in our organization, many with 25 to 30 or more years of experience, eager to use Design signals that it is not 'flavour of the day' but a practical approach to tackling complex issues.

The efforts initiated in this workshop evolved into a larger effort within the Government of Alberta to build an Integrated Resource Management System. As a result of the workshop, the Government of Alberta established a standing cross-ministry systemic design team, a systemic design community of practice, and initiated multiple follow-on projects. Follow-on systemic design projects have ranged from the design of an environmental management agency and common risk management framework for the upstream energy sector to early childhood development.

Comparative Analysis

The first insight from a comparative analysis from a systemic design perspective is that neither methodology is evenly balanced. The Rotman approach is a design methodology informed by some systems techniques. The U.S. Army approach is better characterized as a systems methodology that employs some design methods. It is not necessary for every systemic design project to contain an equal mix of systems thinking and design thinking. The approach should accommodate the requests of the client and the requirements of the situation. However, from the perspective of the integration of systems + design, neither case study produced a true synthesis that balanced systemic thinking and designerly action.

The following attributes were common across the two projects. Both projects shared:

- A process for exploring diverse worldviews and surfacing mental models of participants;
- A holistic view of the challenge (human, technological, and organizational systems);
- A systemic perspective and a problem seeking mindset that helped to reframe the challenge;
- A drive to cut unconventional paths towards goals, as well as to question the goals themselves;
- A willingness to embrace complexity in order to create new opportunities for profound simplicity;
- A willingness for practitioners to adopt a facilitator / enabler role rather than being "The Expert"; and
- A highly collaborative approach that leverages the expertise of each participant.

Table 5 below contrasts some differences between the methodologies as practiced in the case studies.

Table 5. Differences between the Rotman Methodology and the U.S. Army Methodology.

Rotman Methodology	U.S. Army Methodology
Explicit use of empathy (needs before solutions)	Explicit use of systems maps
Physical prototyping	Genealogy to uncover the roots of mental models
Rapid testing / Placing small bets	Theoretical grounding
User feedback	Narrating the journey of learning
Design aesthetic	Integrating education with practice

The Rotman methodology was first derived from the early work of Roger Martin (Rotman), David Kelley (Stanford d.school) and Patrick Whitney (Illinois Institute of Technology). This non-linear, action oriented and emergent form of thinking is a departure from conventional, linear methods of business thinking, yet common practice in highly creative design fields (e.g. industrial, architecture, graphic). The DesignWorks team created a multi-media story to capture the current and ideal Procurement journey. This allowed the department and key stakeholders to understand all aspects of the challenge, from user insight, to ideation, to implementation. Participants in the project learned that adopting a user-centred perspective, and specifically empathizing with users, can greatly transform how problems are framed and innovative solutions are formed.

The U.S. Army methodology produced multiple iterations of systems models using various techniques, such as Rosalind Armson’s (2011) systems maps. Sohail Inayatullah’s (1998) causal layered analysis was used in this case to perform a genealogical analysis of the thinking behind the observed situation. The methodology is strongly grounded in theory, which has been documented elsewhere (Naveh, Schneider & Challans, 2009; Ryan et al., 2010). The systemic design team produced a written narrative to complement the visualisations of their design. This enabled the team to document a detailed written account of their systemic design inquiry at two levels: the content of the workshop, and their journey of learning about design. This reinforced an approach to systemic design that did not separate learning from doing, or theory from practice. Participants learned systemic design at the same time as they acted to resolve a current organisational challenge.

We believe the similarities of the two methodologies provide a common ground on which to build a more centered approach to systemic design, while the differences provide opportunities for learning and improving both methodologies.

Lessons for Systemic Design

The comparative analysis provides some insight on how systems thinking and design thinking can work together. Our analysis draws explicitly on just two data points, so the lessons we present in this section must be seen as suggestive rather than conclusive. Our aim is not to advocate for a particular methodology or variant of systemic design. Rather, we hope to stimulate more conversations between systems thinkers and design thinkers, in order to generate stronger couplings between the two fields.

Both the University of Toronto procurement services and Government of Alberta natural resources case studies demonstrate that systems thinking and design thinking can be successfully integrated. In the University of Toronto case study, systems methods helped the team to better appreciate the user ecosystem and to design an activity system to change end user perceptions of Procurement Services. In the Government of Alberta case study, design methods helped the team to better appreciate diverse stakeholder perspectives, to ideate and to visualize actions to improve inter-departmental collaboration.

A systems approach provides a broader perspective of the problematic situation from which high leverage areas for intervention can be recognized. Design provides a humanistic perspective of the needs of real users, and craft skills for giving tangible form to abstract ideas. These two approaches are highly complementary, and can compensate for one another's weaknesses. Design's ethnographic methods and bias for generative action balances the systems practitioner's tendency to continue to expand system boundaries to broader and more abstract models of the situation. The systems sciences provide a rich body of theory to support design practices that have evolved from craft without rigorous theoretical grounding. A more centered assemblage of systems + design could be qualitatively more powerful than systems thinking or design thinking approaches applied in isolation. For today's and tomorrow's most complex challenges, a new synthesis of systemic design is required.

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